

furnishing all material, labor, tools, equipment and all incidentals necessary to complete this work.

665.8-PAY ITEMS:

ITEM	DESCRIPTION	UNIT
665001-*	PLUGGING GAS WELL	EACH
665002-*	PLUGGING OIL WELL	EACH
665003-*	PLUGGING DRILLED WATER WELL	EACH

*Sequence #

666-669-BLANK:

SECTION 670 WATERLINE INSTALLATION

670.1 – DESCRIPTION:

This work shall consist of the construction or relocation of waterlines, including installation of valves and valve boxes, casing pipe, fire hydrants, water meters, meter boxes, and all required appurtenances all in reasonably close conformity with lines, grades, dimensions and locations shown on the Plans or established by the Engineer.

670.2–MATERIALS:

The material shall meet the requirements of the following subsections.

MATERIAL	SUBSECTION
Controlled Low Strength Material, Type A	219
Ductile Iron Pipe	718.1
Cement lining	718.1.1
Fittings	718.1.2
Mechanical Joints	718.1.3
Push-On Joints	718.1.3
Flanged Joints	718.1.4
Plastic Pipe (PVC)	718.5
Plastic Pipe (Polyethylene)	718.7
Plastic Pipe Fittings	718.8
Copper Service Line	718.9
Copper Service Line Fittings	718.9.1
Gate Valves	718.10
Valve Boxes	718.11
Casing Pipe (Steel)	718.12
Fire Hydrants	718.13
Meters	718.14
Miscellaneous Steel	718.15

CONSTRUCTION METHODS

670.3-GENERAL:

The Contractor shall furnish all materials, perform all excavation and backfill, construct all necessary joints and connections, install all valves, construct all necessary joints and connections, install all valves, construct all appurtenances, install all temporary lines and dispose of all surplus excavation and discarded material and perform all work as may be necessary to complete the water line relocations and installations as set forth in these Specifications and as shown on the Plans.

The Contractor shall assume all risk and bear any loss or injury to property or persons occasioned by neglect or accident during the progress of the work. The Contractor shall exercise special care during the water line relocation so as not to damage any existing utility line or appurtenances.

It is of prime importance that the Contractor, in the performance of their work, does not disrupt the operation of the existing water facilities in any manner or at any time without the express prior approval of the Engineer. Prior notice shall be given to the Engineer by the Contractor of their intention to begin any work that will disrupt or appreciably alter normal system operation so that ample opportunity may be given to the Engineer to notify the owner to prepare for emergency operation, if necessary. The Engineer, upon advice of the owner, will have the sole right of determining at what times and in what order the Contractor shall undertake work involving connections and modifications to the existing system.

The Contractor shall dig test pits as necessary to determine the size of fittings required for connections to existing lines. All material necessary for tie-ins shall be at the work site prior to any disruption of service. Once a connection is started, work shall be continuous until completion. The Contractor shall be responsible for the unloading, storing, hauling, and distribution of all materials and shall replace, at their own expense, all such material that is damaged, destroyed or lost during or after unloading. All pipe, pipe fittings, valves and accessories shall be handled in a manner in order to avoid shock and to protect the coating material. Material not needed for immediate construction shall be stored in a safe manner at places provided by the Contractor and approved by the Engineer.

If the Contractor should observe either proposed or existing sewers or water lines in close proximity the Contractor shall notify the Engineer. The Engineer will determine if the observed situation lacks conformity to the State Department of Health's Design Standards for Water Distribution Systems, its magnitude and the course of action. Additional costs necessitated by a modification in the plan of construction will be paid for in accordance with [109.4](#).

670.4-WATER PIPE:

670.4.1-Trench Excavation: Excavation of the trench may be done either by hand or by the use of suitable trenching equipment. The invert profile as shown on the Plans shall be followed except where changes are authorized in writing by the Engineer to avoid existing structures or to suit topography. The depth of trench shall be increased where necessary to procure a smoothly curved profile or to avoid existing structures. The trench shall be excavated in such a manner as to provide uniform and continuous bearing and support for the pipe and shall be excavated to the depth required to give a minimum of 42 in. (1050 mm) cover from finished grade to the top (outside) of the pipe barrel, except under roadways where minimum cover shall be 30 in. (750 mm) from subgrade to the top of the pipe barrel. The depth of cover may be modified at creek crossings or at other dips in the profile, when approved by the Engineer, providing it does not extend more than 100 feet (30 m) with a cover of less than 42 in. (1050 mm). In the event it is required to decrease the cover to less than 3 feet (900 mm), the pipe line shall be insulated for that distance.

Where stones, dry clay, hard pan, shale or cemented gravel are exposed at the bottom of the trench, the trench shall be excavated to at least 3 inches (75 mm) and not more than 6 inches (150 mm) below the specified grade. Where the bottom of the trench at grade is found to be unstable or include ashes, cinders, all types of refuse, vegetable or other organic material, the Contractor shall excavate and remove such unsuitable material to the width and depth ordered by the Engineer. The trench shall be backfilled to grade with approved material; replacement material shall consist of random material, as directed by the Engineer. Each layer shall not exceed 4 inches (200 mm) compacted depth and shall be compacted in accordance with 670.4.5. The bedding shall be finished by means of hand tools to provide a uniform and continuous bearing and support for the pipe.

Where the bottom of trench at grade is found to consist of material which is unstable to such a degree that in the opinion of the Engineer it cannot be removed and replaced with material suitable to support the pipe properly, the Contractor shall construct a foundation for the pipe, consisting of concrete, pilings, timber or other materials or as directed by the Engineer. Where excavation is made in rock or boulders, the rock shall be removed to provide a clearance of at least 6 inches (150 mm) for pipe 24 inches (600 mm) in diameter or smaller and at least 9 inches (225 mm) for pipe larger than 24 inches (600 mm) in diameter, below and on each side of all pipe, valves and fittings. The trench shall be backfilled to grade with approved material in 4 inch (200 mm) compacted layers. Each layer shall be thoroughly compacted in accordance with 670.4.5 and the bedding shall be finished by means of hand tools to provide a uniform and continuous bearing and support for the pipe. The width of the trench shall be ample to permit the pipe to be laid and jointed properly and to permit the backfill to be placed and compacted as specified. Trench widths shall be in accordance with Table 670.4. 1. Excessive trench widths will not be permitted. Where

necessary for protection of workers or to avoid undermining or otherwise damaging structures or property, the trench shall be properly and sufficiently shored and braced to prevent caving, slipping or cracking of the sides. Where bracing, sheeting or shoring are required or extra width is required for handling of specials, the trench shall be of such extra width to accommodate these items.

TABLE 670.4.1

Pipe Diameter inches (mm)	Trench Width Inches (mm)	Pipe Diameter inches (mm)	Trench Width Inches (mm)	Pipe Diameter inches (mm)	Trench Width Inches (mm)
2 (50)	18-26 (450-650)	10 (250)	22-34 (550-850)	20 (500)	32-44 (800-1 100)
3 (75)	18-26 (450-650)	12 (300)	24-36 (600-900)	24 (600)	36-48 (900-1 200)
4 (100)	18-28 (450-700)	14 (350)	26-38 (650-950)	30 (750)	42-54 (1 050-1 350)
6 (150)	18-30 (450-750)	16 (400)	28-40 (700-1 000)		
8 (200)	20-32 (500-800)	18 (450)	30-42 (750-1 050)		

Blasting for excavation will be performed only after securing the approval of the Engineer and only when proper precautions are taken for the protection of persons or property. The hours of blasting will be fixed by the Engineer. Any damage caused by blasting shall be repaired by the Contractor at their expense. The Contractor's method of procedure relative to blasting shall conform to local and state laws.

The Contractor shall exercise reasonable care to avoid damage to trees and hedges; electric, telephone and gas lines and installations; sewer lines; buildings; roads and all appurtenances thereto. Care shall be used to maintain driveways to permit free access to and from the different properties by the owners.

All excavated material shall be piled in a manner that will not endanger the work and will not obstruct sidewalks and driveways. Fire hydrants under pressure, valve boxes, service stop boxes, fire and police boxes or other utility controls shall be left unobstructed and accessible. Gutters shall be kept clear or other satisfactory provisions made for drainage, and natural watercourses shall not be obstructed. All trenches, material piles, equipment and pipe which may cause a hazard or serve as obstructions to either vehicular or pedestrian traffic shall be enclosed by fences or barricaded and adequately lighted, to protect persons from injury and to avoid property damage. Where traffic must cross open trenches, the Contractor shall provide suitable bridges, which will be subject to approval by the Engineer. The Contractor shall furnish temporary support, adequate protection and maintenance of all underground and surface structures, drains, sewers and other obstructions encountered in the progress of the work.

670.4.2-Laying and Joining: Proper implements, tools and facilities satisfactory to the Engineer shall be provided and used for the safe and convenient prosecution of the work. All pipe, fittings, valves, specials, and fire hydrants shall be carefully lowered into the trench piece by piece by means of a derrick, ropes or other suitable tools or equipment in such a manner as to prevent damage to the water main materials and protective coating and linings. Under no circumstances shall water main materials be dropped or dumped into the trench.

All pipe and fittings shall be carefully examined for defects and no pieces shall be laid which are known to be defective. Any defective or damaged pipe will be rejected. If any defective piece shall be discovered after having been laid, it shall be removed and replaced at the Contractor's expense. All pipes and fittings shall be thoroughly cleaned before they are laid and shall be kept clean until accepted in the completed work. Pipe which has been contaminated by mud or soil shall be cleaned with a swab.

The pipe shall be supported its full length by the uniform grade of the trench. Pipe ends shall not be left open, such as at the end of a day's work or during temporary suspension of construction, but shall be securely covered to prevent the entry of foreign matter or small animals. Kinks or sharp bends giving excessive deflection or which put pipe joints in strain will not be permitted. Table 670.4.2 shows the Maximum permissible deflection for various types of joints or pipe.

**TABLE 670.4.2 MAXIMUM PERMISSIBLE
DEFLECTION PER JOINT**

A. MECHANICAL JOINT PIPE:

Pipe Diameter Inches (mm)	*Maximum Deflection For 18-ft (5.5 m) Length inches (mm)	Pipe Diameter Inches (mm)	*Maximum Deflection For 18-ft (5.5 m) Length inches (mm)
2 (50)	31 (775)	12 (300)	20 (500)
3 (75)	31 (775)	14 (350)	13.5 (340)
4 (100)	31 (775)	16 (400)	13.5 (340)
6 (150)	27 (675)	18 (450)	11 (275)
8 (200)	20 (500)	20 (500)	11 (275)
10 (250)	20 (500)	24 (600)	9 (229)

B. "PUSH ON" TYPE JOINT PIPE:

Pipe Diameter Inches (mm)	*Maximum Deflection For 18-ft (5.5 m) Length inches (mm)
4 (100) thru 12 (300)	19 (475)
14 (350) thru 24 (600)	11 (275)

* Permissible deflection per joint for lengths more or less than 18 ft. (5.5 m) are proportional.

The maximum permissible deflection per joint shall be in accordance with the manufacturer's recommendations.

C. PLASTIC PIPE:

The maximum permissible deflection per joint shall be in accordance with the manufacturer's recommendations.

When cutting short lengths of copper pipe, a pipe cutter shall be used and care shall be taken to make the cut at right angles to the centerline of the pipe. In the case of "push on" pipe, the cut ends shall be tapered with a portable grinder or coarse file to match the manufactured taper.

Rigid plastic pipe such as polyvinyl chloride shall be jointed and laid in accordance with the manufacturers' recommendations. Plastic pipe may be sawn. Thrust blocking, pads, straps and clamp and rod assemblies shall be provided at fittings, valves or specials at the location and in the manner set forth on the Plans.

Joints for various types of ductile iron pipe shall be as follows:

- Ductile Iron Pipe “Push on” joint Type I
- Ductile Iron Pipe Mechanical joint Type II
- Ductile Iron Pipe Flange joint Type III

Type I: "Push on" Type Joint:

"Push on" type joints such as "Bell Tight", "Tite On" or equal joints shall be prepared by removing all dirt or foreign material from the bell end of pipe and inserting the gasket. The spigot end of the pipe shall be prepared by cleaning and applying a thin coat of approved lubricant after which the spigot end shall be centered in the bell and jacked on by using a special jack and choker sling. The procedure in making up this joint shall be performed in accordance with the recommendations of the manufacturer.

Type II: Mechanical joint:

When "making up" mechanical joints, the spigot end of each pipe shall be centered into the adjoining bell to within 1/8 in. of the total depth of the bell. The pipe shall be properly centered and have uniform space all around for reception of the gasket material. The gasket material, bolts, nuts and other accessories used in making mechanical or sleeve type joints shall be obtained from the manufacturer of the pipe and joint.

The surfaces of the spigot and bell shall be brushed thoroughly with a wire brush just prior to assembling. The spigot end shall be brushed with soapy water just prior to slipping the gasket on and entering into the bell.

When tightening bolts the gland shall be brought up toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. This shall be done by partially tightening the bottom bolt first, then the top bolt, next two bolts at either side and last, the remaining bolts. This cycle shall be repeated until all bolts are within the range of thetorques listed below:

Bolt size, Inches (mm)	Range of Torque, Pounds (Newton meters)
5/8 (16)	40 (54) - 60 (81)
3/4 (20)	60 (81) – 90 (122)
1 (24)	70 (95) – 100 (140)
1¼ (30)	90 (122) – 120 (165)

If the effect of sealing is not obtained at the maximum torques indicated above, the joint must be disassembled and reassembled after thorough cleaning. A calibrated torque wrench shall be furnished by the Contractor and made available to the Engineer.

Type III. Flanged joint:

When making up flanged joints, a gasket shall be put in place, the flanges butted together and the bolts tightened in the manner as prescribed for mechanical joints.

Plastic Pipe joints:

Joints in plastic pipe formed of polyvinyl chloride shall be "push on" type. Joints in pipe formed of flexible polyethylene shall be constructed utilizing a plastic, nylon or brass insert secured by stainless steel clamp or may be butt fused or any other approved method as recommended by the manufacture.

Copper Pipe joints:

Copper pipe joints shall be made by use of copper flared joint couplings or fittings unless otherwise specified in the Plans or in the Bill of Materials.

670.4.3-Thrust Blocking: Thrust blocks shall be constructed where called for and to the dimensions shown on the Plans. Concrete used for thrust blocking shall be Class C concrete; however, Class B concrete may be used with no increase in cost.

670.4.4-Nuts, Bolts, Washer, Rods, Straps and Clamps: Where the use of nuts, bolts, washers, rods, straps and clamps is required due to the peculiarities of the installation, these items shall be installed and be of the size and dimension shown on the Plans or recommended by the manufacture.

670.4.5-Backfilling: Backfill material shall consist of suitable random material or controlled low strength material, type A. All material shall be free of particles larger than 3 inches (75 mm) and free from cinders, ashes, refuse, vegetable or other organic material. Controlled low strength material shall meet the requirements of Section 219. Unless otherwise specified on the plans or by the utility, controlled low strength material can be used as a substitute for random material at the option of the contractor.

The backfill material shall be deposited in the trench for its maximum width in layers not exceeding 4 inches (100 mm) after compaction. Quality control testing and acceptance of the backfill material will be according to the applicable sections of 207 and 716 with the following exceptions: The lot size will be one days production or 500 linear feet (150 m) which ever is less for a continuous section of conduit backfilled. The target percentage of dry density will be 95% for the backfill material and each lot shall have 5 density tests performed for quality control.

Backfill placed outside embankments and roadbed is to be compacted to or better than the average total dry density for the existing

670.4.6

soil. An average total dry density will be determined from representative density tests conducted for each existing soil. Quality control testing will normally consist of one test per 500 linear feet (150 m) of conduit installed and lot evaluations are not required. The moisture tolerance is not applicable.

Backfilling shall not be done in freezing weather, except by permission of the Engineer, and frozen material shall not be used. No backfilling shall be made where the material already in the trench is frozen.

From the bottom of the trench to the centerline of the pipe, the backfill material shall be placed by hand and compacted by approved hand tamps. From the centerline of the pipe to a height of 1 foot (300 mm) above the pipe, the backfill shall be placed by hand and compacted by use of approved mechanical tampers. The Contractor shall use special care in placing this portion of the backfill to avoid damaging or moving the pipe. The remainder of the backfill in the trench shall be placed by hand or mechanical means and compacted by approved mechanical tampers. All pipe after being bedded and backfilled shall be adequately protected before heavy equipment is permitted to cross during construction of the roadway. The Contractor will be held responsible for any damage to the pipe resulting from movement of equipment over the pipe. Prior to testing, the pipeline shall be backfilled in accordance with the Specifications.

The Contractor shall maintain the surface of the trench to the original ground surface until accepted by the Engineer. The job site shall be left in a neat and orderly condition to the satisfaction of the Engineer.

Excess material not needed for backfill and material unsuitable for backfill shall be removed from the site and disposed of by the Contractor. Additional backfill material as required to make up deficiency or to replace unsuitable excavated material shall be furnished by the Contractor at no additional cost, from approved borrow pits or from excavations on the roadway.

670.4.6-Testing: Where any section of the main is provided with concrete thrust blocking, the hydrostatic pressure test shall not be conducted until the concrete has reached 2000 psi compressive strength.

Each completed section of pipe line relocation shall be plugged at both ends, and connected to the existing main by means of temporary 1 in. (25 mm) corporation stops and 1 in. (25 mm) copper service lines with backflow prevention devices. After the main has been slowly filled with water in preparation for the hydrostatic pressure test, all air shall be expelled from the pipe. If fire hydrants or blowoffs are not available at high places, the Contractor shall make the necessary taps at points of highest elevation and insert the necessary corporation stops and copper service line in order that the air may be expelled. The main shall be subjected to the hydrostatic test pressure, indicated on the Plans for a period of time in accordance with the provisions herein, and as described in AWWA C600. Pressure shall be applied to the main by means of a hand pump for small lines or by use of a gasoline pump or fire engine for larger lines. During the

duration of the test, the lines shall be thoroughly examined for leakage at the joints and elimination of leakage effected where necessary. "Make up" water shall be measured with a displacement meter. Any cracked or defective pipes, fittings, valves or fire hydrants discovered in consequence of the pressure test shall be removed and replaced by the Contractor at their own expense. After replacing or correcting cracked or defective pipe, fittings or valves discovered in the test or correcting any leakage, the Contractor shall retest the pipe. The allowable leakage for a period of one hour shall be as shown in Equation 670.4.6. In the event the pipe line is tested in sections and temporary thrust blocking is required, a temporary plug or cap shall be installed and blocked with a screw jack firmly braced against the end of the trench or against a heavy timber embedded into the side of the trench.

Where pipe line construction ties into existing lines, and where it is not practicable to make a hydrostatic test testing shall not be required. Any leakage discovered in these sections shall be immediately corrected by the Contractor.

Upon completion of the testing, the temporary corporation stops and lines shall remain in place until the pipeline is disinfected, after which they shall be removed and the taps plugged.

Equation 670.4.6

$$\{\text{English}\} \quad L = \frac{ND\sqrt{P}}{7,400}$$

Where:

L =	allowable leakage, in gallons per hour
N =	number of joints in the length of pipeline tested
D =	nominal diameter of the pipe, in inches
P =	average test pressure during the leakage test, in pounds per square inch (gauge)

$$\{\text{Metric}\} \quad L_m = \frac{ND\sqrt{P}}{130,400}$$

Where:

L_m =	allowable leakage, in liters per hour
N =	number of joints in the length of pipeline tested
D =	nominal diameter of the pipe, in millimeters
P =	average test pressure during the leakage test, in killivolts per ampere

670.4.7-Disinfection: The requirements for disinfection during construction and previous to placing the line in service shall be in compliance with the requirements of the Public Utility involved. In the event the Public Utility has no requirements for disinfection; the following requirements shall govern:

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Each completed section of pipeline constructed shall be sterilized by the addition of one pound (kg) of calcium hypochlorite powder containing 70 percent available chlorine for each 1,600 gallon (10 000 L) of water treated. Table 670.4.7 shows the length of pipe that one pound (0.75 kg) of calcium hypochlorite powder will disinfect. This may be introduced by pumping a liquid solution into the main as it is being filled, or it may be introduced dry by measured amounts placed inside the pipe at each joint immediately before the joint is made. In the latter case the pipe line must be filled from the low point and at a rate not to exceed 20 gal. (75 L) per minute. Water treated with calcium hypochlorite shall remain in the pipeline for a period of 24 hours. After the treated water is retained for the required time, the chlorine residual at the pipe extremities and other representative points shall be at least 50 PPM. Following chlorination all treated water shall be thoroughly flushed from the newly laid lines until the replacement water throughout its length shall be comparable to the quality of water served from the existing system.

TABLE 670.4.7-DISINFECTION CHART

Pipe Diameter Inches (millimeter)	Pipe Length Feet (meter)	Pipe Diameter Inches (millimeter)	Pipe Length Feet (meter)
2 (50)	10,000 (6 700)	12 (300)	270 (180)
3 (75)	4,300 (2 900)	14 (350)	200 (135)
4 (100)	2,500 (1 680)	16 (400)	150 (100)
6 (150)	1,100 (740)	18 (450)	120 (80)
8 (200)	600 (400)	20 (500)	100 (70)
10 (250)	400 (268)	24 (600)	70 (45)

* Length of pipe that one pound (kilogram) of calcium hypochlorite will disinfect.

In lieu of the liquid solution or dry application of calcium hypochlorite, a chlorine gas-water mixture may be introduced by means of a solution-feed chlorinating device. Devices for feeding the gas-water mixture shall provide means for preventing backflow of water into the chlorine cylinder. The duration of treatment and chlorine residual shall be as previously stated.

The Contractor shall contact the County Health Department prior to public use of the drinking water so they may perform sampling and testing in accordance with Health Department requirements.

Disinfection and testing shall be accomplished by the Contractor prior to performing any work in connecting to the existing main.

Where connecting into existing mains and it is not practicable to include the connecting pieces, i.e.; pipe, fittings, valves in the normal disinfecting process, the connecting pieces shall be swabbed with a chlorine solution containing not less than 1% Hypochlorite solution prior to making the connection.

670.5-GATE VALVES AND VALVE BOXES:

Gate valves shall be installed in accordance with 670.4. The valve box shall be set in such manner that no shock or stress is transferred to the valve. The valve box shall be centered and plumbed over the wrench nut of the valve. The valve box cover shall be set flush with the finished surface.

670.6-CASING PIPE:

Construction methods shall be as described under 670.4, where open trench construction is feasible. In the event that boring and jacking methods are specified in the Contract or are otherwise necessary to complete the installation, the applicable provisions of 604.11 shall govern.

670.7-FIRE HYDRANTS:

The work shall be performed in accordance with the requirements of 670.4. When relocating hydrants, no work shall be started on removing a hydrant until the pressure on the hydrant has been shut off. Before relocating a hydrant, it shall be thoroughly cleaned of all dirt and foreign matter.

All hydrants shall be provided with a concrete thrust block or anchorage as shown on the Plans and care shall be taken that the concrete does not obstruct any hydrant drain openings. All hydrants shall be set upon 0.5 cubic yard (meter) of AASHTO # 3 stone to provide drainage for the hydrant. The stone shall extend above the hydrant drain opening to prevent entrance of soil into the hydrant barrel. The thrust blocking and stone shall be placed as shown on the Plans.

670.8-METERS, METER BOXES, AND SPECIAL VALVES AND APPURTENANCES:

The construction method shall be as set forth in 670.4.

When removing and relocating a meter box and lid, the Contractor shall exercise care in order to avoid damaging the box. In the event the box or lid is damaged in performing the work, the Contractor shall furnish replacements in kind.

670.9-SPECIAL STRUCTURES:

Special structures for waterline appurtenances, such as meter pits, special valve pits, etc., shall be in accordance with the applicable provisions of 605.

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670.10-HOUSE CONNECTION:

The work to be performed under this item shall consist of furnishing and installing all pipe, taps, couplings and fittings necessary to provide a connection from the relocated line to a point where the existing house connection is reconnected. Construction methods shall be as described in 670.4.

670.11-METHOD OF MEASUREMENT:

670.11.1-Water Pipe: Water pipe will be measured by the linear foot in place. The measurement will be made along the centerline of such pipeline, before backfilling, to or from the following described points:

- i. At the centerline of the connection where work begins or ends and connection is made to an existing pipe or special.
- ii. At the centerline of the special casting or connection that is part of the new pipeline.
- iii. At the centerline of a fire hydrant or at the face of a dead plug, dead cap, flange, or spigot at the end of the new pipe line.
- iv. At the ends of new inserted material, where connection is made by breaking and insertion in an existing pipeline. This inserted material, regardless of size, will be considered as being of the same size as the connecting pipe and paid for as such.

No deduction in length will be made for valves or fittings.

670.11.2-Casing Pipe: Casing pipe will be measured by the foot (meter) in place. The measurement will be made along the centerline of each casing pipe installed.

670.11.3-Gate Valve and Valve Box, Fire Hydrants, Meters, Meter Valves and Appurtenances, and Special Structures: These items will be measured by the unit.

670.11.4-House Connections: House connections will be measured per linear foot (meter) of pipe, measured along the centerline, complete in place including all taps and all couplings, goose necks, corporation stops, curb cocks, curb boxes or other material necessary to complete the work.

670.12-BASIS OF PAYMENT:

The quantities, determined as provided above, will be paid for at the contract unit price bid for the items listed in 670.13, which prices and payments shall be full compensation for excavation and backfill, except as otherwise provided, testing, disinfecting, thrust blocking, connecting to valves and fire hydrants, all branch connections, fittings, drains, blowoffs

and service connections, reinforcing steel, manhole frame and cover, the repair and repaving of areas not otherwise provided for in the Plans, the removal of all surplus material and clean up, furnishing of all materials and doing all work prescribed in a workmanlike and acceptable manner, including all labor, tools, equipment, supplies, and incidentals necessary to complete the work.

When unsatisfactory foundation materials are encountered at the bottom of the trench, there will be no additional compensation for such excavation and backfill, unless the required excavation and replacement exceeds 1 ft. of depth. Excavation and replacement material in excess of 1 ft., and any special foundation not called for on the Plans will be paid for in accordance with 109.4.

When boring and jacking of casing pipe is specified in the Contract, the cost of the boring and jacking operations will not be paid for separately but shall be included in the unit price bid for the respective casing pipe pay items. If the Engineer determines that field conditions necessitate the boring and jacking of casing pipe not so specified, the casing pipe pay item as originally specified will be non-performed and the cost for such boring and jacking operations, including the cost of the casing pipe, will be paid for in accordance with 109.4.

670.13-PAY ITEMS:

ITEM	DESCRIPTION	UNIT
670004-*	"size" DUCTILE IRON PIPE, TYPE "type**", CLASS "class"	LINEAR FOOT (METER)
670007-*	"size" PLASTIC PIPE, CLASS "class"	LINEAR FOOT (METER)
670008-*	"size" COPPER SERVICE PIPE	LINEAR FOOT (METER)
670009-*	"size" GATE VALVE AND VALVE BOX	EACH
670010-*	"size" STEEL CASING PIPE, THICKNESS "thickness"	LINEAR FOOT (METER)
670013-*	"size" FIRE HYDRANT	EACH
670014-*	RELOCATE FIRE HYDRANT	EACH
670015-*	"size" METER	EACH
670016-*	RELOCATE METER	EACH
670017-*	METER BOX	EACH
670018-*	RELOCATE METER BOX	EACH
670019-*	SPECIAL VALVE, TYPE "type"	EACH
670020-*	SPECIAL STRUCTURE	EACH
670021-*	"size" HOUSE CONNECTION	LINEAR FOOT (METER)

* Sequence Number

**Types

Type I--Push On Type Joint

Type II--Mechanical Joint

Type III--Flanged Joint

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